Design Approach for Dynamic Traffic Control System Based on Radio Propagation Model in VANET

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Abstract

In the densely populated urban area traffic control system is the main mechanism to control the flow of vehicular traffic at the intersection. Conventional traffic control system are not capable of handling dynamic vehicular flow. This dynamic vehicular flow creates traffic jams , congestion at the intersection. Vehicular Ad hoc Network (VANET) is a common part of Intelligent Transport System (ITS) which is directly involved in handling these problems and aims to make journey on road comfortable. The urban traffic flow depends on the driver behavior, and also, it is influenced by traffic control and environmental factor. As the number of vehicles in urban area is increases, the traditional traffic system faces so many problems. This paper describes a working a VANET environment and then a brief study of dynamic traffic system based on radio propagation model. This traffic system uses a clustering algorithm at the intersection. Then we conclude the system working.

Keywords: *Traffic light, clusters, mobile vehicle, vanet*

1. Introduction

Now a day's traffic management in urban areas plays a very important role. Road accident is one of the most commonly incident occurs with the human lives in day-to-day lives which causes to death of many human lives. This dynamic traffic flow also causes congestion or improper management of traffic system at the intersection. Traffic congestion is one of the leading causes of lost productivity and decreased standard of living in urban areas. [1][2]. This increase in vehicular traffic in urban scenarios has resulted into an inefficient traffic flow. Higher traffic in the city generates severe problems like accidents, congestion, pollution etc. To handle all these problems and also to make traffic free flow on the intersections some intelligent traffic must be designed . Modifying existing traffic control system infrastructure is much expensive and basically not possible. Instead of changing existing infrastructure ,new scheduling in traffic lights system can be made to handle dynamic vehicular traffic flow at the intersection or lanes in the cities[3].Vehicles in the traffic are mobile nodes i.e. they are moving from one place to another place[4].Vehicular ad hoc networks (VANET) is a most suitable environment to demonstrate vehicular operation at the intersection in the urban cities[4].

There is a tradional traffic system exist which works on a specified time cycle at the intersection.

In this type of traffic system is also called as static traffic system. Hence whenever the traffic is increased at the intersection it is unable to handle the vehicular traffic flow. This system is also causes much congestion, traffic jams at the intersection in busy street hours. To handle all the above stated problems a dynamic system should be designed which should work according to the density of vehicular traffic flow. This paper presents a detail study of adaptive traffic system based on radio model.

The rest of the paper is organized as follows. Section II gives a brief overview of the working of vanet environment. Section III describes the system design and clustering algorithm used for implementing the system. Section IV describes conclusion & future work.

2. VANET Environment

In VANET, the networking/computing devices are mostly installed on cars, with possibly a small number of them installed at fixed locations called Road Side Units (RSU). Road side unit improves connectivity between the vehicles by acting as hubs. One of the main goals of the project was to turn each moving car into a sort of mobile sensor, that are able to observe and report about various phenomena, possibly but not exclusively related to traffic. The VANET may also play additional roles; for instance, it may allow information to flow back from the data center to the cars (e.g. delivery of traffic alerts or route prescriptions to individual users or groups) as well as from car to car (e.g. direct dissemination of traffic data, forward collision warnings, coordination or entertainment within platoons of vehicles) [2][4].The current trends of VANET are reviewed by Abdalla et al. The relationship between VANET and intersections is bidirectional. While using VANET, traffic controllers can be aware of traffic parameters on the streets and act based on these data; the mobility models for VANETs are affected by the intersection management policies

2. 1 Working of VANET Environment

Vehicular Ad-Hoc Network (VANET) is a form of Mobile Ad-Hoc Network. .VANET environment is consist of the vehicles(mobile nodes) in the route which

are moving every time, RSU(Road side units),OBU's(onboard unit),Communication Links etc.
On-Board Units (OBU's): It is a mobile device which is connected to the mobile node (vehicles) and used to transmit or receive data in adhoc network. RSU (Road side units): It is a fixed device placed anywhere within the range of adhoc network. Its function is to extend the communication range of adhoc network. It provides connection to OBU's and forwards data

Communication Link: In adhoc network there is a wireless link used to transfer data from one node to another node or from one unit to another unit.
Vehicular Networks System consists of large number of nodes, approximately number of vehicles exceeding 750 million in the world today [4], these vehicles will require an authority to govern it, each vehicle can communicate with other vehicles using short radio signals DSRC (5.9 GHz), for range can reach 1 KM, this communication is an Ad Hoc communication that means each connected node can move freely, no wires required, the routers used called Road Side Unit (RSU), the RSU works as a router between the vehicles on the road and connected to other network devices. Each vehicle has OBU (on board unit), this unit connects the vehicle with RSU via DSRC radios, and another device is TPD (Tamper Proof Device), this device holding the vehicle secrets, all the information about the vehicle like keys, drivers identity, trip details, speed, route[1][2] etc, see figure 1.

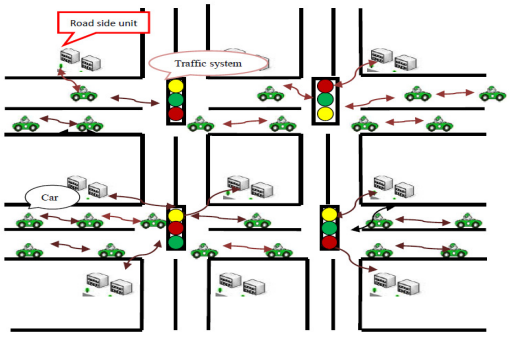

Figure (1) Working of Vanet Environment

3. System Architecture

To design a dynamic traffic signal system, a system must acquire the vehicular traffic flow information i.e. no of vehicles coming towards the different intersection, no. of outgoing vehicles from the intersection, and the density of vehicular traffic at the intersection. Vehicular adhoc network is used in this system to create a network between the mobile vehicles and for communication purpose. In vanet sensor are placed inside the mobile nodes called as vehicles. The overall working of VANET environments is given in section-II. Traffic system light will work according to the density of mobile nodes at the intersection. To calculate the density of node a clustering algorithm is used. This algorithm is also used to gather the information about the vehicles activity. This clustering is known as direction oriented clustering algorithm. This algorithm combines two functionality: one forms clusters and second provides a data dissemination technique for data transmission between the various units in vanet environment. Cluster is formed around the intersection and the density of vehicular nodes is calculated.All nodes Clusters is created based on the direction of vehicular node movement. Cluster each cluster has various communi Direction of the vehicle can be determined using any location finding devices for eg. GPS(global positioning system).

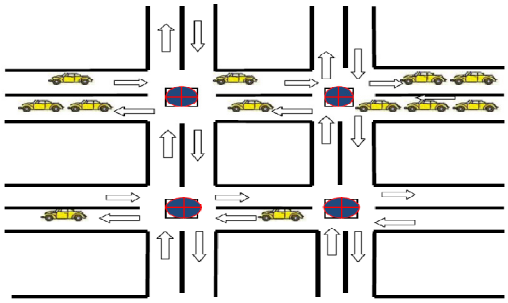

Figure (2) Traffic System Scenario

Traffic signals as we all know consist of multiple outgoing and incoming lanes and the traffic signal system situated at the center of the intersection.
Traffic signal system consists of four colors of light system. Figure (2) shows a traditional traffic system consist of traffic lights for each lane. Each lane at the intersection consist of two lanes one for incoming vehicle and another of outgoing vehicles. Vehicles in the lanes can move in four direction i.e. Right, Left-Turn,& Straight.
Figure (3) show a system design of adaptive traffic system. This system when implemented will work according to the density of nodes at the intersection.

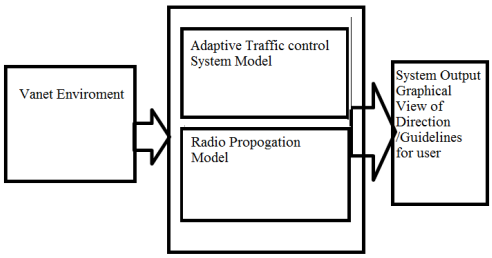

Figure (3) System Architecture

As shown in figure it consists of basic four units. VANET environment, Adaptive traffic control system model, Radio propagation model system output model. Working of Vanet environment is discussed in detail in section II. Adaptive traffics control system is system which will work according to the flow of vehicular

traffic at the intersection. This system uses a clustering algorithm to calculate the node density at the intersection .It consist of three color lights phases to control the signal system at the intersection. In the this system green light time should be increased at that intersection of the density of node is more and vice versa so that in other lane waiting queue of vehicle will be less This adaptive system will also decreases the waiting time of the vehicle in the queue at the intersection

Density	Direction	Group	Arrival Time	Cluster Length

Figure(4) Packet Transmitted to the traffic signal Control

As shown in figure (4) the data packet is transmitted from node to traffic control system having various information about the network vehicle.
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4. Radio propagation model

The radio propagation model is also called as channel model used for characterization of radio propagation. To check whether the link is currently available between the nodes in the system this radio propagation model is used. This model predicts the path loss i.e. to determine the available wireless links among vehicles, or to determine the transmitter's effective coverage range. The widely used radio propagation models are Free space model and Two-ray ground model due. They are widely used because of their simplicity. [12]

5. Conclusion & future work

In this paper the we presented a detail study of dynamic traffic control system This system when implemented will overcome the problem caused by tradition traffic system . This system is based on radio propagation model for predicting path loss & link. This will be able to work on a particular area of the city. also discussed. Data forecasting model are used for transmitting data form one node to other node. We have also discussed radio propagation model used in adhoc network which are used to detect the path link breaks in the network. In the future this system may be implemented for practical implementation which will work for various dynamic vehicular flow.

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